

Coordinate System, Temperature and Gravity

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Abstract

We discuss the problem of applicability of Coordinate Systems (or Frames) that determine (t, x, y, z) values - the initial notions for most physical theories. Equipment that measure these values - Clocks and Meters - are based at Reference System and are the primary measuring units. We discuss when and why physical phenomena might prevent to provide measurements of (t, x, y, z) . We show that Temperature may be the factor that can significantly influence on the measurements of (t, x, y, z) by Reference System and that action may violate the usage of Coordinate System. We discuss possible origin of such unmovable Temperature and assume that it should be Gravity.

1 Introduction

Thermodynamical and Chaotic behavior in the presence of strong Gravity were studied a lot during last 30 years ([1], [2], [3] and ref. there in). In this notes we would like to attract ones attention to small aspect of this advanced matter. All notions and models that are used in Physics have their own applicability conditions. For example the usage of geometric optics approximation, continuum media approximation, free harmonic oscillator etc. are reduced by certain physical factors. To check up the usage conditions one make experiment to compare it's results with applicability conditions and predictions of the model. Having that in mind we are interested in the problem of possible reduction of usage of Coordinate System (*CS*) or Frame - fundamental notion that is in the basement of Physical models and theories. The problem we are going to discuss concern possible reduction of usage of *CS* due to Thermodynamical factors and hence relations between Temperature and Gravity are of high interest.

2 Coordinate system usage conditions.

CS - is a mathematical notion, as well as Observer, Frame etc., used to determine (t, x, y, z) coordinates and metrics and is the basement for geometrical approach to Gravity and Space-Time description. All physical processes are described in certain *CS* and (t, x, y, z) variables are the most fundamental physical values. The applicability (or non applicability) of *CS* for the description of the given physical state is determined by the chance (or no chance) for that particular physical state in real (or imaginary) experiment to provide the measurements of (t, x, y, z) by physical equipment. Such measurements in real or imaginary experiment are realized by special unit - Reference System (*RS*). We treat *RS* as a physical equipment, like Meter and Clocks, to measure main physical properties - Time and Distance (t, x, y, z) . As well *RS* has equipment for transmitting and receiving measured information from and to other *RS*.

It is well known that (t, x, y, z) coordinates determined by certain *CS* are the only parameters that characterize local geometry of Space-Time. *CS* determine (t, x, y, z) free from other physical properties, hence *RS* measuring unit that confirm the usage of given *CS*, must to measure (t, x, y, z) free from any external physical influence. Experiments prove that one able to reduce

and avoid the influence of electromagnetic fields, particles, thermal influence of surrounding media, rain, wind, etc. on the measurements of (t, x, y, z) . Ability to avoid any external influence on measurements of (t, x, y, z) equals applicability of *CS* and physical models based on that notion.

Let's assume now, that for certain physical state it is actually impossible to avoid or to reduce the influence of surrounding physical factors, temperature in particular, on the measurement units of the *RS*. Suppose, that such unmoved Thermal action significantly act on the measurements of (t, x, y, z) and information exchange. Imagine, that Temperature T of the *RS* units for such physical state, as well as temperature of any other bodies or electromagnetic fields equals $10^5 K$ and can not be decreased by any means. Suppose, that no screens, coolers or any other physical device or effects exist, that can protect the measuring devices from such temperature or to reduce it value. Then, even if one assume that certain Meter and Clock, as well as receiver/transmitter of information can ever exist at such high temperature, the results of the measurements for such exotic state must depend on the value of the temperature. Then such unmovable non-reduced temperature T should be treated as fundamental property of such exotic state, as (t, x, y, z) . Appearance of additional physical factor - Temperature - at least as fundamental as (t, x, y, z) - in the set of primary observables quit applicability of common *CS* and physical models based on it for the description of that particular physical state. Even if (t, x, y, z) do not depend on the value of Temperature directly, one should find new fundamentals to describe physical state with primary observables (T, t, x, y, z) , where T is the min Temperature obtained for given *CS*.

Why it is difficult to describe such exotic physical state with primary measurable values (T, t, x, y, z) where temperature T define unmovable non reduced temperature of the local area measured by *RS*? We will mention only few problems.

- Since Temperature become fundamental property, like Time, than Thermodynamics must be treated as fundamental theory, and it can not be derived from Mechanics or other theories, based on *CS*. Statistical ensembles and other notions of Statistical Physics have no usage for this case.
- Most Mechanical notions lose applicability and one not able to use Free Space approximation, Vacuum states, Phase Space, Kinetic description and other common models. *CS* has no use for such states.

- Unmoved Thermal action on the instruments means that all classical measurements have finite accuracy and thus no small Time or Distance scales exist in such physical state.

3 Thermal Gravity

Do such states exist? What can be the origin of such unmoved and non reduced temperature and why it might be impossible to protect the instruments from the temperature action?

As usual Thermal properties are associated with Matter and Electromagnetic fields (mainly). Temperature of bodies, temperature of particles, temperature of continuum media, temperature of radiation - are the main sources of Thermal influence. Present experience prove that one able to reduce such Thermal action and to protect *RS* measuring units from such influence.

We suppose that Gravity itself should be origin and source of unmovable Thermal influence for certain physical states. At the same time we remind internal contradiction of our treatment: properties of present physical models are based on the applicability of *CS*. We use them to demonstrate possible existence of Thermal properties of Gravity. That violate the use of *CS* and models based on it. So, our reasons show definite internal contradiction of modern physical fundamentals, at least.

The physics of Thermal Gravity component assumed similar the Electromagnetic Thermal fluctuating radiation [4]: hot matter radiate Thermal Electromagnetic field and this Thermal fluctuating field heat matter.

Similar to that [5] Free Fall Acceleration (*FFA*) induced by any macro body consist of the main averaged part (the main factor) and negligible fluctuating Thermal component that reflect the Thermal state of the particles of the body. Thermal component of *FFA* is neglected due to it's careless vanishing influence but it is not correct to forget it at all. (We use *FFA* as simplest property of Gravity).

The significant property of this small Thermal constituent of *FFA* is ability by direct action to heat any matter and Electromagnetic field.

Otherwise it will contradict with the Second Law of Thermodynamics [6]. If Thermal *FFA* component induced by Thermal behavior of particles of macro body will produce only regular movement of test particles without any heating, then one will have the way of direct transfer of any value of

heat into regular mechanical movement. Such process should decrease the Entropy for sure.

It is lucky chance the coupling *const* of Gravity is much more less than for Electromagnetic interaction. Due to that Thermal component of Gravity is careless and *RS* measurements of (t, x, y, z) describe reality with high accuracy. But size of coupling *const* can not forbid existence of that effect.

The most significant is the actual existence of Thermal Gravity component. Let us mention Bondi [7], who in 1961 pointed out possible existence of gravity fields induced by atoms and even by protons and electrons. But, due to Uncertainty Principle he assumed that it is impossible to measure these values. We suppose, that universal Thermal action of such Gravity fields, and those induced by molecules, is exactly the factor that prevent such precise measurements. One able to measure only Thermal action of such Gravity, induced by warm particles, and not able to measure these values in pure dynamical sense. It seems that such Thermal reduction of Gravity measurements accuracy is much more rough than $\hbar/2$ factor and that also should be the trouble on the way as to Quantum Gravity as to Gravity waves detection.

In the "area" with significant value of Thermal *FFA* component all bodies, fields, equipment of *RS* will be heated up to certain value of Temperature T_g . That temperature will be unmovable and no physical means exist that can decrees this Temperature due to universal action of Gravity. One able to protect the *RS* units from Thermal electromagnetic influence, but fail to reduce or reflect the action of Thermal *FFA* heating effect. Anything that interact with Gravity will be heated by it's Thermal component. The Temperature T_g , induced by such Thermal Gravity component become the fundamental property of the area and must be treated as basic as (t, x, y, z) if they can be ever measured. Indeed, Temperature of instruments will reduce accuracy of measurements. On the other hand high Temperature Gravity may thermalize any regular signal and the only information that will be received by external *RS* will be only Thermal. In such area the set (T_g, t, x, y, z) should be treated as primary measurable values and that violate usage of *CS*.

And what can be said about the High Temperature Gravity areas? Do they exist?

We assume, that High Temperature Gravity should exist and should be measured by *RS* near the Infinite Red Shift surface. Thermal equilibrium conditions [8] requires $(g_{00})^{1/2} = \text{const}$. As g_{00} vanish to zero at infinite red shift surface (Shwarzshild radius $r_g = 2GM/c^2$ for mass M) then $T_g \rightarrow \infty$ if it is positive far from Black Hole. That violate the usage of *CS* (or "Observer"

notion) for certain $r_{cr} > r_g$ due to critical value of Temperature T_{cr} .

The second case of high temperature action of Gravity should exist for the RS that moves with near light speed with respect to certain preferred RS_p . Indeed, if small Temperature of Gravity T_g exist than one can chose RS_p that measures the lowest value of such Temperature. The Observer in the RS that moves with speed v with respect to RS_p should measure [9] the Temperature of Gravity $T = T_g(1 - b^2)^{-1/2}$, $b = v/c$. Thus RS will be under critical Thermal action of Gravity if it moves with critical speed $v_{cr} < c$ with respect to preferred RS_p . That means that Thermodynamics have it's own restrictions for speed $v < v_{cr} < c$ to reach the speed of light value and that reduce applicability for CS as well.

Our considerations on possible violation of applicability of CS do not touch the usage of most physical phenomena, except Black Holes physics and description of Universe as a whole. Possible existence of self Gravity Temperature violate usage of CS above infinite red shift surface and reduce acceptable speed value by certain $v_{cr} < c$. That means that Gravity can not be described by models based on CS anywhere and Universe evolution models might be restudied. We suppose that one else explanation of observed Microwave Background Radiation can be discussed: this radiation should reflect averaged Temperature of Gravity in our area and it's Temperature should be treated as Gravity's Temperature $T_g = 2.7K$.

Conditions for which one should take into account the Temperature of Gravity and will fail to use CS as basement of the theory are more than exotic. For example, to measure $T_g = 1000K$ it is required $\Delta r = r - r_g = r_g(T_g/2.7)^{-2} = r_g 10^{-6}$; $\Delta v = c - v = c(T_g/2.7)^{-2} = 10^4 cm/c$

We are lucky to live in the cold Gravity area and thus able to use CS to describe Physics. If Temperature of Gravity really exist, then Gravity itself should be treated as origin of Thermal properties. For certain exotic cases Thermal and Space-Time variables can not be measured separately. Some new approach to describe such states should be suggested. In any case the relations between Gravity and Temperature and their measurements problem should be studied.

4 Conclusions.

A lot of *Pro* and *Contra* arguments may be added to the reasons that we briefly presented above to demonstrate possible existence of self Gravity Tem-

perature, corresponding measurements problem and applicability of Coordinate System problem. But the questions: What are actually the applicability conditions of Coordinate System? Can Thermodynamics and Temperature in particular make any difficulties for measurements procedures? Do Gravity have Temperature and how it can be measured? - these and some other questions should be studied to make our understanding of the relations between Thermodynamics and Gravity more precise.

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